REMARKS/ARGUMENTS

The claims are 1-2 and 4-5. Claim 1 has been amended to specify that the mantle-side fill opening is disposed between the gas-permeable checker bricks as shown for example in FIG. 2. Reconsideration is expressly requested.

Applicant would like to thank the Examiner for the courtesy of a Telephone Interview on February 11, 2009, the substance of which is set forth herein and in the Interview Summary dated February 18, 2009. In the Final Office Action, claims 1 and 2 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Keller et al. U.S. Patent Application Publication No. 2002/0134706* in view of *Autenrieth et al. U.S. Patent No. 5,935,277*, and *Stewen et al. U.S. Patent No. 5,137,602* as evidenced by *Sharma et al. U.S. Patent No. 4,741,515*. The remaining claims 4 and 5 were rejected under 35 U.S.C. 103(a) as being patentable over *Keller et al.*, *Autenrieth et al.*, *Stewen et al.* and further in view of *Vora et al. U.S. Patent No. 6,280,609*, and *Apfell U.S. Patent No. 4,597,788*.

During the Interview a proposed amendment to claim 1 was discussed as set forth herein along with the prior art references. No agreement was reached and the Examiner indicated that Applicant should present his arguments in a formal response to the Office Action and he would consider them.

Accordingly, Applicant has amended claim 1 as discussed at the Telephone Interview and respectfully traverses the Examiner's rejection for the following reasons.

As set forth in claim 1 as amended, Applicant's invention provides a fission reactor shown for example in FIG. 2. The fission reactor is for a Claus plant. As shown in FIG. 1, fission reactor 1 includes a boiler 9 lined with refractory material.

Boiler 9 includes a combustion chamber 2 having an inflow opening 12 shown in FIG. 2 for a mixture of heating gas, air and acid gas containing H_2S. Boiler 9 also includes a catalyst chamber 10 shown in FIG. 1 having a catalyst bed 3. Boiler 9

also includes an outflow-side chamber 11 having a gas outlet 13 shown in FIG. 2 for hot process gas containing elemental sulfur.

As shown in FIGS. 1 and 2, the boiler is configured as a horizontal cylindrical boiler, in which the combustion chamber 2, the catalyst chamber 10, and the outflow-side chamber 11 are disposed next to one another. The catalyst chamber 10 is delimited, on both sides, in the flow direction, by gas-permeable checker bricks 14 containing elongated holes. The catalyst chamber also has a mantle-side fill opening 15 shown in FIG. 2, which is disposed between the gas permeable checker bricks 14, for introducing the catalyst bed 3.

Prior fission reactors for a Claus plant used a vertical shaft oven that had a combustion chamber at its upper end and a bed of loose catalyst bulk material below the combustion chamber. This arrangement required a great height for the oven with the flow passing from top to bottom which in turn required a complicated scaffolding to absorb wind stress. Also, there was the problem that flames can flash over from the combustion chamber to the catalyst bed and damage the catalyst.

Applicant's fission reactor has solved these problems for a Claus plant by the arrangement and structure set forth in Applicant's claim 1 as amended.

The primary reference to *Keller et al.* describes a method for desulfurization of a gas stream, particularly the desulfurization of natural gas for which the Claus process is said to be unsuitable due to the loss of hydrocarbons during combustion and catalyst contamination. See paragraph [0006] of *Keller et al.*

Keller et al. therefore proposes an arrangement that avoids the Claus reaction equilibrium required by the combustion of H_2S to SO_2. See paragraph [0028].

FIG. 2 of *Keller et al.* shows an arrangement of three zones: a mixing zone 48, a reaction zone 45, and a cooling zone 55.

Mixing zone 48 is not a combustion chamber. The gas that is fed in has a temperature between 40 and 350°C, preferably not more than 200°C. See paragraph [0066], last sentence.

Thermal shield 46 is specifically provided between the mixing zone 48 and the reaction zone 45 to prevent combustion of the reactant gases prior to contacting the catalyst in reaction zone 45. See paragraph [0030].

Keller et al. also does not have gas-permeable checker bricks with elongated holes delimiting both sides of the catalytic chamber. Rather *Keller et al.* has thermal radiation barriers 46 in front of catalyst device 47 and upstream of catalyst device 47. Although radiation barriers 46 are porous, they are not checker bricks with elongated pores as recited in Applicant's claim 1 as amended.

The barrier 46 in front of catalyst device 47 prevents heating of the reactants before entering the reaction zone 45 and contacting the catalyst. See paragraph [0066] of *Keller et al.* The barrier 46 upstream of catalyst device 47 provides thermal insulation between the reaction zone and the cooling zone.

Keller et al. also does not have a mantle-side fill opening for introducing a catalyst fill. With Applicant's arrangement as

recited in amended claim 1, the fill opening is disposed between the gas-permeable checker bricks. Thus, the catalyst can be replaced but not the checker bricks through the fill opening. In *Keller et al.*, a fill opening would do no good because *Keller et al.* uses thin layers or mats which fill the entire diameter and cannot be introduced through a mantle-side filling opening. See paragraph [0051].

If the catalyst mats of *Keller et al.* were to be replaced, it is respectfully submitted that one would do so by replacing them in the longitudinal direction. A mantle-side opening would be too large because the mats fill the entire inside diameter and have to be inserted in one piece. *Keller et al.* cannot use pourable material as the catalyst because he requires low thickness for the brief contact of the gas with the catalyst which is critical to his process.

The secondary reference to *Autenrieth et al.* has been cited as teaching an opening 25 in FIG. 3 in the side of the reaction section as a preferable way of removing catalyst 2 without

requiring demounting operations on the reactor housing. See col. 7, lines 4-35 of *Autenrieth et al.*

First, it is respectfully submitted that a person skilled in the art would have no reason to even consider *Autenrieth et al.* to modify the *Keller et al.* system as *Autenrieth et al.* relates to a reforming reactor for mobile applications using a catalyst pellet fill which is entirely unsuitable for *Keller et al.'s* system where he requires very brief contact between the catalyst and the gas.

Second, even if *Keller et al.* and *Autenrieth et al.* were combined in the manner suggested by the Examiner, one would still not achieve Applicant's fission reactor as recited in claim 1 as amended. *Autenrieth et al.* uses an upper fill opening (charging tube 14) to fill catalyst material, not opening 25 as asserted by the Examiner. See FIGS. 1 and 2 and col. 5, line 66 to col. 6, line 6 of *Autenrieth et al.*

The removal opening (outlet tube 24) inserted into housing passage opening 25 is disposed beneath the upper fill opening in

the lower portion of the reactor. See FIG. 3 and col. 7, lines 4-16 of *Autenrieth et al.*

Thus, *Autenrieth et al.* requires space ducts 1a as connecting channels so that the catalyst material can get from the upper portion to the lower portion of the reactor. See col. 3, lines 43 to 47. There is no disclosure or suggestion of simply one opening between two gas-permeable checker bricks having elongated holes.

In view of *Autenrieth et al.'s* teaching that spacer ducts are necessary to connect two parts of the reactor between an upper fill opening and a lower outlet opening, it is respectfully submitted that one skilled in the art would have no reason to modify *Keller et al.* to provide such ducts and openings. Moreover, doing so would go against *Keller et al.'s* purpose to have brief contact time. In any event even if one skilled in the art were to do so, one would still not achieve Applicant's fission reactor as recited in claim 1 as amended in which checker bricks with elongated holes delimit both sides of the catalyst chamber.

Stewen et al. has been cited as teaching checkers to provide a uniform flow pattern and *Sharma et al.* has been cited as indicating that porous ceramic refractory elements are inclined to have non-uniform gas flow. *Stewen et al.* however, teaches providing a plurality of air inlets 4 and 5 (FIGS. 1 and 2 and FIGS. 9 and 10) or a progressively changing cross-sectional structure of the bricks (FIGS. 3-5 and FIGS. 6-8) which is contrary to *Keller et al.'s* need for a short contact time of the gas with the catalyst. Thus, it is respectfully submitted that one skilled in the art would have no reason to replace *Keller et al.'s* thin thermal shields with checkers because *Stewen et al.* teaches that multiple air inlets or progressively changing cross-sectional structures are needed to achieve uniform flow. In addition, nothing in *Sharma et al.* indicates otherwise.

The remaining references to *Vora et al.* and *Apffel* cited against dependent claims 4 and 5 have been considered but are believed to be no more relevant. There is no disclosure or suggestion in either of these references of modifying *Keller et al.* to have a combustion chamber, gas-permeable checker bricks

with elongated holes, or a mantle side fill opening disposed between the checker bricks.

As instructed by the Manual of Patent Examining Procedure §2141.02 VI, a prior art reference must be considered in its entirety, i.e., as a whole, including portions which would lead away from the claimed invention. As discussed in Applicant's Response to Second Office Action filed July 7, 2008, *Keller et al.* is replete with statements that distinguishes his system as employing a completely different functional principle from a Claus plant. As previously explained, <u>no</u> Claus process is supposed to be carried out in *Keller et al.* see, in particular [0028], whereby only short-term contact between the gas mixture fed in and the catalyst is provided. For this purpose, no combustion is provided either. Instead, the waste gases are fed in at a temperature between 40 and 450°, preferably not more than 200°C. See paragraph [0066] of *Keller et al.*

Because according to *Keller et al.* no Claus process is specifically intended to be conducted, and merely very brief contact between the catalyst and the gas is provided, during

which chemical equilibrium cannot come about, no catalyst fill is provided within the catalyst chamber delimited by checker bricks. Instead, thin layers or mats (See paragraph [0051]) are suspended in the device. The catalyst mats are rigid structures that fill the entire diameter.

Thus, the following structural differences exist between the arrangement between *Keller et al.*. and Applicant's fission reactor:

- *Keller et al.* does not disclose a boiler having a fire-proof lining and a combustion chamber. Combustion of the gases fed is not provided. The gases are merely fed in in the warm state, and mixed, and subsequently reacted purely catalytically;

- a catalyst chamber that is delimited on both sides in the flow direction by gas-permeable checker bricks that have oblong holes is not provided; and

- the device does not have any mantle-side fill opening for introducing a catalyst fill, let alone one disposed between the checker bricks.

As recited in Applicant's claim 1 as amended, the catalyst fill is independent of the checker bricks in that the fill opening is disposed between the delimitations formed by the checker bricks whereby replacement merely of the catalyst fill and not of the checker bricks is provided. With *Keller et al.*'s system, catalyst mats are provided, which form a unit and are replaced as a whole, if at all.

The above structural differences between Applicant's fission reactor as recited in claim 1 as amended and *Keller et al.'s* reactor requires that the manner in which Applicant's fission reactor as recited in claim 1 as amended is operated be taken into account. Unlike the situation where the prior art apparatus teaches all the structural limitation of a claim, see MPEP 2114, a recitation with respect to the manner in which a claimed apparatus is intended to be employed can be considered in an obviousness determination where the rejection is based on a

combination of references. It is respectfully submitted that the recitation in claim 1 as amended that the fission reactor is for a Claus plant is relevant as to whether the hypothetical combination made by the Examiner would in fact be made.

In addition, it should be noted that the Manual Patent Examining Procedure §2143.01 VI instructs that if the proposed modification or combination of the prior art would change the principle of operation of the prior art being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.

Thus, for example, changing thermal shields to checker bricks would change the principle of operation of the system of *Keller et al.* which wants short contact time between gas and catalyst. Having a mantle-side opening for introduction of catalyst would also be contrary to *Keller et al.'s* purpose to use such thin thermal shields for the reasons previously expressed.

Accordingly, it is respectfully submitted that claim 1 as amended, together with claim 2 and 4-5 which depend directly or indirectly thereon, are patentable over the cited references.

In summary, claim 1 has been amended. In view of the foregoing, withdrawal of the final rejection and allowance of this application are respectfully requested.

Respectfully submitted,
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